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Effect of Division by Factors Approach on the Pupils' Achievement in Division of Whole Numbers at Upper Primary School Level in Enugu State, Nigeria.

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Abstract
The study was conducted to ascertain the effect of division by factors approach on the pupils' achievement in division of whole numbers. The sample for the study was 406 pupils which were randomly selected from the 52 primary schools in Nsukka central of Nsukka local government area in Enugu state. The instrument used for the study was division of whole numbers achievement test (DIWHONAT). The data obtained with the instrument were analyzed using mean and Analysis of covariance (ANCOVA). Mean was employed to answer the research questions posed, while ANCOVA statistic was used in testing the null hypotheses at the 0.05 level of significance. Findings of the study showed that the division of whole numbers achievement test was effective in enhancing pupils achievement in division of whole numbers. It was recommended, among others that mathematics teachers should use the division by factors approach in teaching division of whole numbers by another whole number. More so, teachers should use the division by factors approach in other mathematics topics or aspects such as division of decimal numbers.

Introduction

Emphasis on primary education has been made in the general objectives of the primary education in the National Policy on Education (2004) because of the immeasurable importance of Mathematics. With particular reference to the aims and objective of primary education, the general objective for mathematics education (FRN, 2004) are:

> *To generate interest in mathematics and to provide a solid foundation for everyday living; to develop computational skill to foster the derive and ability to be accurate to a degree relevant to the problem at hand; to develop precise; logical and abstract thinking; to develop the ability to recognize problems and to solve them with related mathematical knowledge; to provide necessary mathematical background for further education; and to stimulate and encourage creativity (pp. 13 – 14)*

Ideally, Mathematics teaching and learning at the primary school level is a crucial one because this is a stage upon which future Mathematics learning will be built. Acquisition of Mathematics skills and proper enhancement of Mathematics learning should start right from the primary school level because failure to acquire the fundamentals at early stages in learning will lead to backwardness in Mathematics achievement in later years. Therefore a weak Mathematics foundation at primary school level may lead to poor attitude, low participation and poor achievement in Mathematics at secondary school and tertiary levels respectively (Usman and Nwoye, 2010).

Despite the recognition accorded to Mathematics as a pivot upon which social, economic, technological development, everyday practices of man and the break though in the millennium development goals hinges, Unodiaku (2010) pointed out that there is persistent gaps between curriculum planners' intention and what is obtainable in Mathematics classroom. The result of these gaps is poor performance among the learners. Several factors have been identified by researchers as being responsible for the gaps/poor performance among the pupils. For instance, from the researcher's experiences and interaction with the pupils and students the researcher observed that these learners are still finding Mathematics more difficult compared with other subjects offered in schools, because they lack readiness for Mathematics learning. Other reasons offered include, most teachers use wrong methods in presenting Mathematics and in handling the children (Igwebuike, 1985); teachers inability to use problem solving method and other techniques such as questioning, assignment cards, individual and group methods (Igboko, 1976); and pupils poor performance in Mathematics is mainly caused by the use of wrong methodology by most teachers (Flectcher, 1951). Obviously emphasis is on teachers' use of wrong methods in teaching Mathematics to pupils. Yet more, Unodiaku (2012) explained that students' poor performance in Mathematics stems from their lack of readiness in studying it as well as teachers' failure to use appropriate teaching methods, teaching materials and illustrations in teaching and failure to evaluate what was taught. Consequently, teaching resulted to poor learning and achievement in the subject.

Despite these persistent reports on students' poor performance in Mathematics, efforts are still being made to remedy this problem of poor performance of students in Mathematics learning. It has been suggested that Mathematics teaching and learning should involve the use of games (Agwagah, 2001; and Ogbuanya, 2009). According to Ogbuanya (2009), the use of games apart from enhancing cognitive development, their use to assess cognitive readiness of students has an advantage over the use of ordinary entry behaviour test. More so, Mathematics teaching and learning should involve games in order to arouse the interest of pupils in Mathematics which will be helpful to achieve a better performance in Mathematics (Agwagah, 2001). The use of games will not only make teaching and learning more interesting but will serve as a method that will leave permanent impressions in the minds of the learners. Integrating games into Mathematics classroom is capable of improving the interest and achievement of the learners in Mathematics learning.

In the recent time, Universal Basic Education (UBE) was introduced into primary school system with the anticipation that it will help Nigeria to achieve success in meeting up with Millemium Development Goals (MDGs). The emergence of the U.B.E was accompanied with new Mathematics topics which include binary system and number and Nummery application to real life problems. The incorporation of new topics in the primary school curriculum was aimed at attaining the MDGs. The newly introduced topics as well as previously existing topics demand better, easy and interesting approaches that are innovative in nature and can enhance students' achievement in Mathematics. Teachers cling to traditional methods, and because of that the power of thinking, understanding and retention are not thus developed in the pupils (Kulbir, 1995). If the pupils do not show any interest or perform poorly in Mathematics, it can be created not by blind memorization or teacher clinging to traditional methods, but by shifting the methods. "Long Division Method" is certainly the most difficult of the fundamental processes to teach as well as the most tedious to perform (Kulbir, 1995). One of the interesting, easy and innovative approaches of teaching and performing division of whole number by another is the division by factors.

Division can be defined as sharing or finding the value of one when that of many things is given (Kulbir, 1995). Division is usually taught last of the four simple rules namely addition, subtraction, multiplication and division. This is undoubtedly its logical position, because a good knowledge of addition, subtraction and multiplication is necessary for the understanding of the theory underlying this process (Kulbir, 1995). For instance, division may be regarded as shortened subtraction. Thus the question involved in $30 \div 5 =?$ may be worded as, "how many times can 5 be subtracted from 30? The same question can be worded as, "by what must I multiply 6 to get the answer 42?"

Insofar divisions do not exceed the limits of the multiplication table; it is customary to work by the process called short division. The process of division is carried out from left to right. Division by factors follows naturally from "short division" whereby the divisor is broken up into simple and convenient factors. The division by factors method of solving arithmetic's problems is expected to enhance pupils achievement in division of whole numbers as well as relief teachers of the traditional method they use in division of whole numbers. Division of whole numbers is a topic in primary schools Mathematics curriculum which many teachers are finding difficult to teach due to lack of better, easy interesting and innovative approaches. Therefore the use of divisions by factors approach may serve as a great relief to the primary school teachers in search of better, easy or interesting approach for teaching the topic. The use of division by factors method is illustrated below taking the following procedure.

Procedure

Step 1: Introduction of the division by factors method

Step 2: Illustration using examples

Example 1: Divide 786 by 28 by the method of division by factors.

***Solution*:** The divisor 28 can be broken up into two factors,

viz: 4 and 7

4	786	groups of 4 + 2 unit
7	196	groups of 28 + 0 groups of 4 + 2 unit
	28	

Therefore Quotient = 28

and Remainder $0 \times 4 + 2 = 2$

$$\therefore \frac{786}{28} = 28\frac{2}{28} \text{ or } 28\frac{1}{14} \text{ (by reducing the fraction to the lowest term)}$$

Example 2: Divide 3764 by 36 using method of division by factors.

Solution: The divisor 36 can be broken up into two factors i.e. 4 and 9

4 | 3764
9 | 941 groups of 4 + 0 unit
| 104 groups of 36+ 5 groups of 4 + 0 unit

Therefore Quotient = 104
and Remainder 5 x 4 + 0 = 20

$\therefore \frac{3764}{36} = 104\ \frac{20}{36}$ or $104\frac{5}{9}$

Example 3: Divide 4848 by 42 using method of division by factors.
Solution: Break up 42 into two factors i.e. 6 and 7

6 | 4849
7 | 808 groups of 6 + 1 unit
| 115 groups of 42 + 3 groups of 6 + 1 unit

Therefore Quotient = 115
and Remainder = $3 \times 6 + 1 = 19$

$\therefore \frac{4849}{42} = 115\ \frac{19}{42}$

]

Purpose of the study

The main purpose of the study was to find out the effect of division by factors approach on pupils' achievement in learning division of whole numbers. Specifically, the study sought to determine:

- The effect of division by factors approach on the mean achievement scores of pupils in learning division of whole numbers.
- The effect of gender on division by factors means achievement scores in learning whole numbers.

Research Questions

The study was guided by the following research questions.

1. What is the difference between the mean achievement scores of pupils taught division of whole numbers with division by factors approach and those taught with conventional method?
2. To what extent does gender influence the mean achieve ment scores of the pupils taught division of whole numbers using division by factors approach?

Research Hypotheses

1. There is no significant different between the mean achievement scores of pupils taught division of whole numbers with division by factors method and those taught with conventional method.
2. There is no significant difference between the mean achievement scores of boys and girls taught division of whole numbers with division by factors approach.

Research Methodology

The research design for the study was quasi- experimental research design. Specifically the study adopted pretest – posttest – non- equivalent control group design. The study was purposely carried out in Nsukka central of Nsukka local government area of Enugu state. Nsukka central was purposely chosen because pupils in this locality are more exposed to qualified Mathematics teachers, teaching materials and facilities than pupils in the rural area of Nsukka. Out of 117 primary schools in Nsukka, Nsukka central was composed of 52 publicly owned primary schools. Multi- stage random sampling technique was adopted in selecting 203 primary six pupils used for the study. Eight schools were randomly selected out of the 52 primary schools in the area of the study. This was followed by randomly selecting six intact classes from the eight schools. Three of the six selected schools were randomly assigned into experimental group, composed of 98 pupils, while the remaining three schools were assigned to control group, composed of 105 pupils.

The instrument used for the data collection was called division of whole number achievement test (DIWHONAT) and was developed by the researcher. The DIWHONAT essay items were facially validated and the reliability coefficient of the DIWHONAT was determined, using Cronbach alpha technique. A reliability coefficient of 0.08 was obtained. Out of 16 items developed, 11 items survived the validation and reliability processes. Consequently, the DIWHONAT was composed of 11 items used for the study. Mean and standard

deviations were used in answering the research questions. The research hypotheses were tested using the analysis of covariance (ANCOVA) at $p < 0.05$. The pretest scores were used as covariance to the post test.

Results

The results of the study were presented in line with the research questions and hypotheses.

Research Questions 1: The research question one was answered using Table 1 below.

Table 1: Summary of Mean Achievement and Standard Deviation (S.D.) Scores of Experimental and Control Groups in DIWHONAT

		Pretest		Posttest	
Group	No of Pupils	Mean	S.D	Mean	S.D
Experimental	196	9.136	0.73	9.19	1.164
Control	210	7.235	.070	7.19	1.058

Table 1 shows that pupils in experimental group had mean and S.D. of 9.136 and 0.73 scores in pretest respectively and mean and S.D. of 9.19 and 1.164 respectively in posttest. Pupils in control group had mean score of 7.235 and S.D. of .070 in pretest and mean and S.D. scores of 7.19 and 1.058 respectively in posttest.

Research Question 2: The research question two was answered using Table 2 below.

Table 2: Summary of Mean Achievement and S.D. Scores of Boys and Girls in Problem Solving in Division of Whole Numbers Achievement Test (DIWHONAT)

			Pretest	Posttest	
Gender	No of pupils	Mean	S.D.	Mean	S.D.
Boys	203	8.559	.075	8.62	1.417
Girls	203	7.812	.075	7.68	1.424
Both Sexes	406	7.97	.078	8.15	1.494

Table 2 reveals that boys had mean and S.D. of 8.559 and .075 respectively in pretest and mean and S.D. of 8.62 and 1.417 respectively in posttest. The table also shows that girls had mean and S.D. 7.812 and .075 respectively in pretest and mean and S.D. of 7.68 and 1.424 respectively in posttest. Both sexes had mean and S.D. of 7.97 and .078 respectively in pretest and mean and S.D. of 8.15 and 1.494 respectively is posttest.

Research Hypotheses 1 and 2 were answered using Table 3 below.

Table 3: Analysis of Covariance (ANCOVA) Table of Boys and Girls Scores on Mathematics Achievement Test.

Source	**Type 111 sum**	**df**	**Mean square**	**F**	**Sig.**	**Result**
Corrected model	507. 672	4	126.918	128.242	.000	S
Intercept	437.597	1	437.597	442.162	.000	S
Pretest	11.980	1	11.980	12.105	.001	S
Gender	43.529	1	43.529	43.983	.000	S
Group	337.229	1	337.229	340.747	.000	S
Gender* group	.017	1	.017	.017	.897	NS
Error	396.860	401	.990			
Total	27890.000	406				
Corrected total	904.532	405				

S = significant at 0.05 probability level
NS = Not significant

Table 3 presents the statistics of the distribution of difference between the paired differences (paired scores), the 95% confidence interval of the difference, the value of F (340.747) is significant at 0.000. This F value is equally significant at 0.05. Therefore hypotheses of no significant mean difference between experimental and control groups is not accepted. Hence there is a significant difference between the mean achievement scores of pupils taught division of whole numbers with division by factors approach and those taught with conventional method. More so, the value of F (43.983) is significant at 0.000. This F value is equally significant at 0.05 level.

Therefore hypothesis 2 of no significant difference between the mean achievement scores of boys and girls taught division of whole number with division by factors approach was rejected. Hence there is significant difference between the mean achievement scores of boys and girls taught with conventional method and division by factors approach in favour of pupils that were taught using division by factors approach.

Findings

From the analysis of data as presented in this study, the following major findings were made.

1. The mean achievement score of boys taught with division by factors approach was significantly higher than the mean achievement score of girls taught with conventional approach.
2. The mean achievement score of pupils taught using the division by factors approach was significantly higher than the mean achievement score of pupils taught using conventional approach.

The mean achievement score of boys exposed to both division by factors approach and conventional approach was significantly higher than the mean achievement score of girls exposed to both methods. In other words boys achieved significantly higher than girls in both experimental and control groups.

Discussion

Based on the findings, it was obvious that pupils who were taught with division by factors method achieved better than pupils who were taught with conventional method. From table 3, the significant difference between conventional method and experimental method was attributed to the effect of division by factors method used. This may be due to the fact that the new method is convenient and less rigorous to apply. It is such method that pupils will find interesting and easy to use and will hopefully raise their moral in studying mathematics. This finding supported (Abrimbade, 1995; Awofala, 2002; and Olosunde and Olaleye, 2010) who all asserted that teaching method is a major contributory factor to students' achievement and attitude to mathematics. This also confirm Kulbir's (1995) view that pupils demonstrated greater understanding of Mathematics as a result of exposure to division by factors approach.

The findings in Tables 2 and 3 showed that boys achieved significantly higher than girls in the overall results. This result indicates that gender is a significant factor on students' achievement in Mathematics. This report is in accordance with earlier findings (Osafehint 1998; Olosunde and Omolayo, 2010; and Unodiaku, 2010) which have indicated that male learners consistently obtained significantly in mathematics achievement scores than their female counterpart especially from the age of 11 years upward. However this finding contradicted Hilton and Bergland (1974) and Agwagah's (1993) findings which revealed that female students made higher gains in the mean achievement score than the male students. These findings revealed that the issue of gender as factor of mathematics achievement is inconclusive. There is need for further enquiry to clarify this notion.

Recommendations

Based on the findings of the study the following recommendations were made:

1. Division by factors approach should be incorporated in the primary school mathematics curriculum as technique to be used in teaching arithmetic in the classrooms.
2. Professional bodies such as science teachers Association of Nigeria (STAN), Mathematical Association of Nigeria (MAN) among others, should organize workshops/seminars to popularize and sensitize Mathematics teachers on the use of Division by factors method in teaching pupils to divide whole numbers by another.
3. Teacher training institutions of learning should include the division by factors method in the Mathematics method course content. This will ensure that after the teachers training, they will be equipped on how to divide whole number by another easily and accurately.

Conclusions:

The findings of this study have shown that the use of division by factors approach does enhance the pupils' achievement in Mathematics. Thus, some relationships exist between the techniques of instruction and learners skills in solving problems involving division of whole number by another. The findings also suggest that Mathematics teachers should recognize that in today's Mathematics classes, students in the classes are composed of different sexes with varied ability levels and as such strategies to encourage and enhance maximum achievement by all in such classes should be adopted. To this end division by factors approach can be included as one of the major approaches to arithmetic instruction in Nigeria primary schools Mathematics classrooms.

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